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ABSTRACT

The United States Training and Employment Service General Aptitude Test Battery (GATB), first published in 1947, has been included in a continuing program of research to validate the tests against success in many different occupations. The GATB consists of 12 tests which measure nine aptitudes: General Learning Ability; Verbal Aptitude; Numerical Aptitude; Spatial Aptitude; Form Perception; Clerical Perception; Motor Coordination; Finger Dexterity; and Manual Dexterity. The aptitude scores are standard scores with 100 as the average for the general working population, and a standard deviation of 20. Occupational norms are established in terms of minimum qualifying scores for each of the significant aptitude measures which, when combined, predict job performance. Cutting scores are set only for those aptitudes which aid in predicting the performance of the job duties of the experimental sample. The GATB norms described are appropriate only for jobs with content similar to that shown in the job description presented in this report. A description of the validation sample is also included. (AG)

TECHNICAL REPORT

ON

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

OFFICE-MACHINE SERVICEMAN (any ind.) 5-83.111

B-511
(Supersedes B-279 and B-500)

U. S. Employment Service
in Cooperation with
Ohio and California State Employment Services

April 1963

GATB/796 c
and 2383

STANDARDIZATION OF THE GENERAL APTITUDE TEST BATTERY

FOR

OFFICE-MACHINE SERVICEMAN (any ind.) 5-83.111

B-511

(Supersedes B-279 and B-500)

SUMMARY

The General Aptitude Test Battery was administered to two samples in this occupation for the purpose of validating and cross-validating occupational norms. The date of criterion collection and the number included in each final sample is shown below.

Sample	Year	N
Validation (Ohio)	1952	62
Cross-Validation (California)	1961	55

On the basis of mean scores, standard deviations, correlations with the criterion, job analysis data, and their combined selective efficiency, Aptitudes S-Spatial, P-Form Perception, K-Motor Coordination and M-Manual Dexterity were selected for inclusion in the final test norms.

GATB Norms for Office-Machine Serviceman 5-83.111 B-511.

B-1001			B-1002		
Aptitude	Tests	Minimum Acceptable Aptitude Score	Aptitude	Tests	Minimum Acceptable Aptitude Score
S	CB-1- F CB-1- H	95	S	Part 3	90
P	CB-1- A CB-1- L	85	P	Part 5 Part 7	85
A	CB-1- C CB-1- K	80	K	Part 8	80
M	CB-1- M CB-1- N	90	M	Part 9 Part 10	85

Effectiveness of Norms

The data in Table IVA indicate that 12 of the 20 poor workers, or 60 percent of them, did not achieve the minimum scores established as cutting scores on the recommended test norms. This shows that 60 percent of the poor workers would not have been hired if the recommended test norms had been used in the selection process. Moreover, 37 of the 45 workers who made qualifying test scores, or 82 percent, were good workers.

I. Purpose

This study was conducted to determine the best combination of aptitudes and minimum scores to be used as norms on the General Aptitude Test Battery for the occupation of Office-Machine Serviceman 5-83.111.

II. Sample

Validation Sample - Ohio

The GATB, B-1001, was administered during the period August 16, 1951 to September 9, 1952 to a final sample of 62 male Calculating-Machine Serviceman trainees. Some of the trainees were men hired by the Friden Calculating-Machine Company, Incorporated, Cleveland, Ohio, to be trained at the Service Training Center in Cleveland. These men are sent to various parts of the country to work after training. Some of the trainees sent to the Service Training Center in Cleveland were from privately owned Friden Agencies in the Eastern part of the country. The training time is 12 weeks. No tests were used in the selection of the trainees; applicants were selected by interview only.

Cross-Validation Sample - California

The GATB, B-1002A, was administered during the period March 15, 1960 to June 9, 1961 to a final sample of 55 male Office-Machine Serviceman employed by firms and educational agencies in the Southern California area: Autonetics, Division of North American Aviation, Inc.; Bank if America; Long Beach Unified School District; Los Angeles City Board of Education; and the Unified California Bank. Aptitude tests were not used to select trainees for this occupation in any of the firms. The educational agencies required that each applicant pass a civil service examination (general information test items) for entrance as a helper or apprentice. Entrance requirements vary, but most companies preferred hiring repairmen with one or more years of experience. All applicants were required to complete an application form and were orally interviewed; trainees were screened according to interests and related mechanical training or experience. The experienced applicants were usually required to qualify on a work sample test; the applicant had to be able to locate the cause of malfunction of a machine and make the appropriate minor repairs within a limited period of time. There were no age or educational requirements for the experienced serviceman, but most of the employers preferred to hire high school graduates between the ages of 18 and 40 years of age as trainees. The minimum length of time for training in this occupation is about six months; all individuals in this sample are considered experienced.

TABLE I-A

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Criterion (r) for Age, Education, and Experience

Validation Sample - Ohio

N = 62	M	σ	Range	r
Age (years)	26.2	5.3	17-40	-.075
Education (years)	11.3	1.6	8-16	-.037

TABLE I-B

Means (M), Standard Deviations (σ), Ranges, and Pearson Product-Moment Correlations with the Critorion (r) for Age, Education, and Experience

Cross-Validation Sample - California

N = 55	M	σ	Range	r
Age (years)	39.3	11.3	21-61	.024
Education (years)	11.1	1.7	7-14	-.011
Experience (months)	154.1	104.6	7-456	.076

III. Job Description

Job Title: Office-Machine Serviceman (any ind.) 5-83.111
(Supersedes B-279 and B-500)

Job Summary: Inspects, repairs cleans, and adjusts office machines such as adding, calculating, and duplicating machines, manual and electric typewriters, time and date stamps, and check-writers in customers' establishments or in repair shop. If service cannot be rendered on premises, removes machine to repair shop and installs another machine as a temporary replacement.

Work Performed: Receives, reviews, and files repair orders and service call sheets; and establishes daily service route. Determines types and quantities of replacement parts and materials required for the day and prepares and submits requisitions for parts and materials. Drives truck or car to service stops. Locates, identifies and checks warranty status of machines.

Removes outer casing and other machine parts to visually and manually inspect, adjust, align, clean and lubricate. Prepares and/or replaces defective parts; tightens or resolders loose connections on electric machines; and reassembles and operates machine to verify satisfactory operation. Refers to diagrams or schematic drawings if necessary. Refers to manufacturers's guides and handbooks to diagnose malfunctions and/or determine disassembly or assembly procedures, when necessary. Removes electric motors and cleans machines; replaces worn and broken parts and resolders loose connections; and reassembles and realigns moving parts. Tests machines for satisfactory performance.

On work order, records conditions of machines, causes of malfunctions, service and corrective actions taken; parts used and time on jobs. Maintains daily time card to record time spent on each job. Attends training sessions on new machines and on modifications of machines in use. May supervise, instruct, and assign simple service operations to helpers and apprentices. May instruct customers in machine operations. May try to sell new machines and supplies to service customers.

IV. Experimental Battery

All the tests of the GATB, B-1001, were administered to the Validation (Ohio) sample group. All the tests of the GATB, B-1002A, were administered to the Cross-Validation (California) sample group.

V. Criterion

Validation Sample (Ohio)

The final criterion for this sample consisted of instructors' ratings expressed in three broad categories. These broad category ratings were converted to three quantitative scores.

Cross-Validation Sample (California)

The final criterion consisted of supervisory ratings based on USES Form SP-21, "Descriptive Rating Scale," and prepared by the first-line supervisor. Two sets of ratings were obtained for each worker with an interval of 14 to 75 days between ratings. A reliability coefficient of .93 was obtained for the two sets of ratings. The final criterion consisting of the combined rating scale scores; the distribution of combined scores had a range of 35-87, with a mean of 62.8 and a standard deviation of 12.1.

VI. Qualitative and Quantitative Analyses

A. Qualitative Analysis:

The job analysis indicated that the following aptitudes measured by the GATB appear to be important for this occupation:

Intelligence (G) - required to think through difficult problems of malfunctioning and to be able to acquire the necessary fundamental knowledge of machine operation.

Spatial Aptitude (S) - required to learn to trace the mechanical operations of the office-machine and to understand how each part works in conjunction with other parts.

Form Perception (P) - required to identify machine parts and to perceive interrelationships among these parts in order to determine type and extent of repairs or service needed.

Finger Dexterity (F) and Manual Dexterity (M) - required to work accurately with the hands and fingers in removing and installing machine parts, and in using hand tools.

On the basis of the job analysis data, aptitude V-Verbal Aptitude was considered as "irrelevant" for successfully performing the duties of this job.

B. Quantitative Analysis:

TABLE II

Means (M), Standard Deviations (σ), and Pearson Product-Moment Correlations with the Criterion (r) for the Aptitudes of the GATB; N = 62 Validation Sample

Aptitudes	M	σ	r
G-Intelligence	112.3	17.3	.256*
V-Verbal Aptitude	105.9	17.4	.067
N-Numerical Aptitude	106.3	16.6	.110
S-Spatial Aptitude	119.0	16.9	.469**
P-Form Perception	107.0	17.1	.449**
Q-Clerical Perception	95.5	18.0	.405**
A- Aiming	100.7	20.9	.482**
T-Motor Speed	103.3	21.3	.533**
F-Finger Dexterity	109.0	18.9	.139
M-Manual Dexterity	112.8	21.0	.515**

**Significant at the .01 level
*Significant at the .05 level

C. Selection of Test Norms: Validation Sample

TABLE III

Summary of Qualitative and Quantitative Data

Type of Evidence	Aptitudes									
	G	V	N	S	P	Q	A	T	F	M
Job Analysis Data										
Important	X			X	X				X	X
Irrelevant		X								
Relatively High Mean	X			X						X
Relatively Low Sigma										
Significant Correlation with Criterion	X			X	X	X	X	X		X
Aptitudes to be Considered for Trial Norms	G			S	P	Q	A	T		M

Trial norms consisting of various combinations of Aptitudes G,S,P,Q,A,T and M with appropriate cutting scores were evaluated against the criterion by means of the Phi Coefficient technique. A comparison of the results showed that B-1001 norms consisting of S-95, P-85, A-80 and M-90 had the best selective efficiency. The equivalent B-1002 norms are S-90, P-85, K-80 and M-85.

VII. Validity of Norms

The validity of the norms was determined by computing a Phi Coefficient between the test norms and the criterion and applying the Chi Square test. The criterion was dichotomized by placing 32 percent of the sample in the low criterion group because this percent was considered to be the unsatisfactory or marginal trainees.

Table IV-A shows the relationship between B-1002 norms consisting of Aptitudes S, P, K and M with critical scores of 90, 85, 80 and 85, respectively, and the dichotomized criterion for Office-Machine Serviceman 5-83.111. Trainees in the high dritorion group have been designiated as "good trainees" and those in the low criterion group as "poor trainees."

TABLE IV-A

Validity of Test Norms for Office-Machine Serviceman 5-83.111
(B-1001: S-95, P-85, A-80, M-90) (B-1002: S-90, P-85, K-80, M-85)

Validation Sample (Ohio)

N = 62	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	5	37	42
Poor Workers	12	8	20
Total	17	45	62

Phi Coefficient = .50
χ^2 = 15.748
P/2 < .0005

The data in the above table indicate a significant relationship between the test norms and the criterion for the validation sample.

Cross-Validation

Table IV-B shows the relationship between B-1002 norms consisting of Aptitudes S, P, K and M with critical scores of 90, 85, 80 and 85, respectively, and the dichotomized criterion for Office-Machine Serviceman 5-83.111. Workers in the high criterion group have been designated as "good workers" and those in the low criterion group as "poor workers."

TABLE IV-B

Cross-Validation of Test Norms for Office-Machine Serviceman 5-83.111
(B-1001: S-95, P-85, A-80, M-90) (B-1002: S-90, P-85, K-80, M-85)

Cross-Validation Sample (California)

N = 55	Non-Qualifying Test Scores	Qualifying Test Scores	Total
Good Workers	7	28	35
Poor Workers	12	8	20
Total	19	36	55

Phi Coefficient = .40
X^2 = 9.020
P/2 < .005

The data in the above table indicate a significant relationship between the test norms and the criterion for the cross-validation sample.

VIII. Conclusions

On the basis of the results of this study, Aptitudes S, P, K and M with minimum scores of 90, 85, 80 and 85, respectively, have been established as B-1002 norms for Office-Machine Serviceman 5-83.111. The equivalent B-1001 norms consist of S-95, P-85, A-80 and M-90.

IX. Determination of Occupational Aptitude Pattern

Of the existing 35 OAP's (revised 10/61), a significant relationship between OAP-31 and the criterion for the experimental sample was obtained. The proportion of the sample screened out by OAP-31 was .11, which is within the required range of .10 to .60. Therefore, the occupation Office-Machine Serviceman 5-83.111 will be incorporated into OAP-31.